



A Fuzzy Rule Based Expert System to Diagnostic the Mental Illness (MIDExS)

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ABSTRACT: The mental illness diagnostic expert system is designed to help or assist the psychology doctors to diagnosing the various mental disorders related to human. This expert system can be used to perform some evaluation of patient's physical and emotional symptoms to diagnose the particular disorder. This expert system handles the various types of pathologies that more often appear as Anxiety disorder, Adjustment disorder, Impulse control disorder, Mood disorder and Neuro cognitive disorder causing a micro level damage to individual. This expert system uses three AI techniques: Fuzzy generator, Fuzzy logic and rule based reasoning. We are going to describe a new method for creating a weighted fuzzy rule to deal with the mental illness. The fuzzy rule is a causal rule. Its IF part truly cause the THEN. The knowledge of human expert system in the area of mental ill and disorder is transformed and often encoded into the knowledgebase using a fuzzy logic and then provide the severity of any particular disorder. The main objective of this paper is to develop an expert system which deals with the various disorders related to psychology.

KEYWORDS: Fuzzy reasoning; 15 mental disorder; Record of pattern; Diagnose the psychological disorder

I. INTRODUCTION

People drive us to know about the various events that are happening around us. The psychology is a scientific study of mental experiences processes and behavior of human. Whenever we meet someone doing something, then we try to understand why person is doing something like that. Sometimes we often try to understand own activities in different situation. The psychology disorders are varying from one person to another person. The diagnosis of psychology is not easy to diagnose by clinical features. They have some specific sign and symptoms and cause. Analyzing the behavior of human is being facing daily life events. We try to analyze why do they become happy or sad? Why and when they are developing friendly relationships? How some people learn quickly or some takes a time to learn something? In the *abnormal behavior* and or *mood behavior* or *impulse behavior* or *anxiety behavior* is difficult to examine or define because of the inherent to the subject.

In medical field the diagnosis is the process of recognition of a disease based on the some physical and emotional symptoms of the patient that appears. The major issue involve in the diagnosis is risk factor. This MIDExS takes the primary sign and symptoms of the patient whether the symptoms are physical or emotional. This expert diagnose the disorders like Anxiety disorder, Mood disorder, Impulse control Disorder, Neuro cognitive disorder. The relationship between cause and symptoms of the patient to create the number of hierarchical set of rules and these rules are used to create knowledgebase that will help the doctors to diagnose the particular psychology disorder. Some types of psychology disorder leads to the nerve system of individuals. It is very common to observe that how people react that when a person suffers from a psychological disorder. Although she/he is treating from the corresponding specialist. And most of them observe that this person with suspicion. There are some common types of psychology disorders are related to the nervous system. Such disorders lead to the damage of impulse and nerve system and affect the critical thinking and memory capacity of the person. The resources need binding of the individual in social area. The major difficulty in diagnosing the psychology disorder is that whether a person really suffering from the psychology disorder, although these symptoms are very small. This system will take symptoms as input and on the basis of these physical and emotional symptoms it will diagnose the disorder. This expert system will not only simplify the task of psychologist doctors but also assist the patient.

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II. PROCESS CHART OF MENTAL ILLNESS DIAGNOSTIC EXPERT SYSTEM

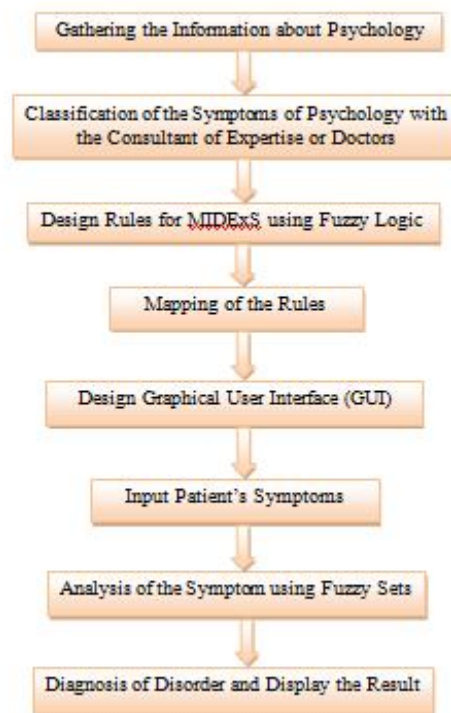


Fig.1 Flow chart of Mental illness diagnosis expert system

a) Gathering the information about psychology: In the first step we gather the information about the psychology disorder from the doctors and expertise and appropriate books about psychology disorder and their treatments. Knowledge is gained from the books of psychology disorders. We know that information about medical field is most important part to take into the consideration which is present in hospitals. This information is considered as the subjective information.

b) Classification of the Symptoms of Psychology with the Consultant of Expertise or Doctors: after gathering the information about the psychology disorders. Expert system divided the sign and symptoms into two categories: 'Physical Symptoms' and 'Emotional Symptoms'. On the basis of physical and emotional symptoms this expert system generate list of diagnosis. In this phase it describes the categorization of sign and symptoms of psychology disorder. The diagnosis of psychology disorder depends on the priority of the individual symptoms. Generating a list of categorization is the most difficult task in medical because of the importance of all medical information

c) Design Rules for MIDeXS using Fuzzy Logic: after categorization of the individual physical and emotional symptoms of the psychology disorder, we generate fuzzy rules of the various disorders; range is assigned to individual symptoms on basis of their weight age. Fuzzy rule is a casual rule. It's IF part contains the facts and THEN part contains the consequence. The physical symptom chest pain is low or medium or high, then on the basis of the ranges conclusion deduced, whether disease is in first or second or third stage.

d) Mapping of the Rules: after generating the rules of physical and emotional symptoms, the entire symptoms are always checked to correctness of disease (output) on the basis of correct symptom (input).

e) Design Graphical User Interface (GUI): The mental illness diagnosis expert system is developed using MATLAB R2013a. The rules are developed using fuzzy logic. This graphics interface phase provides the Physical and Emotional symptoms of the patients. User has to fill out either they have physical and emotional symptoms on the GUI. GUI is based on the interaction between the patient and medical doctor. The symptoms of the patients are input into this system.

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f) Input Patient's Symptoms Analysis of the Symptom using Fuzzy Sets: Rules of disease are entered in the database correctly. Fuzzy systems are mostly used to design the decision support system. This system contains more than 10,000 rules of 25 Disorder. Disorder of the patient is diagnose on the basis of particular physical and emotional symptoms.

g) Diagnosis of Disorder and Display the Result: This is final phase of the system. In this phase a particular disorder is diagnose on the some physical or emotional symptoms. The final output is evaluated.

III. METHODOLOGY

Mental diagnose work proposes using fuzzy logic system design and simulation. Mental illness diagnoses systems based on the fuzzy set of rules. Fuzzy logic was initially developed by Zahed. A review of existing research on the psychology disorders and its strategy of management with fuzzy logic were carried out. The word psychology word I is origin from the two Greek words 'psyche' and 'logos'. The word psyche means to the soul and logos means to the study. In this research the psychology disorders from a combined dangerous effect of various disorders related to the impulse control disorder, anxiety disorder, mood disorder, Neuro cognitive disorder. Fuzzy sets are the artificial techniques that provide the appropriate solution the particular problems. Fuzzy logic deals with the real world problems in which data is not precise or accurate. Fuzzy logic is based on the reasoning. The fuzzy rule is a causal rule; it means whose IF part truly causes the THEN part.

In medical diagnose this is possible to be worked with the assertion, exact definition and descriptions. Fuzzy logic makes diagnose possible to define the exact defining medical entities as fuzzy set. Fuzzy logic provides the powerful reasoning technique that handles the imprecise and uncertainties in data to diagnose mental disorders. There is very rarely sharp boundary between the various psychological disorders. Psychological disorder is the best example, because there are a large number of physical and emotional symptoms that are vague. The relationship between sign and symptoms and disease are analyzed. While complexity of the system is increased, it is not easy to take the particular path in which conclusion is deduced. Fuzzy expert system plays an important role in medical field. Dealing with development of expert system and diagnose decision one is very depend on the quality of data. It is very important to that how to describe the behavior and properties of quantitatively and qualitatively. This expert system divided into modules: ANXITETY, ADJUSTMENT, MOOD, NEURO CONGINITINE and IMPULSE CONTROL DISORDER.

a

3.1 KNOWLEDGE ACQUISITION FOR THE OBJECTIVE ANALAYSIS

Stress is the most common mental illness problem. A person who has suffering from stress feels lost of interest, sadness, worthless, and cannot perform their function properly. A major stress can be characterized by one or more stress episode. The fig.3.1 shows the FIS of stress disorder. It has five major physical symptoms that cause stress. The input parameters are the most important to take into the consideration. We find various kind of disorder that is related to each symptoms of each specialist. The system's efficiency is determined by the choice of membership we have used. In this mental illness system, there are many physical and emotional symptoms that have not the particular value. Beside from the membership value function, there are some another factors like conjunction; disjunction and NOT that we really need to take into the account. For the input variable, the type of each variable is represented by **triangular and trapezoidal** membership function.

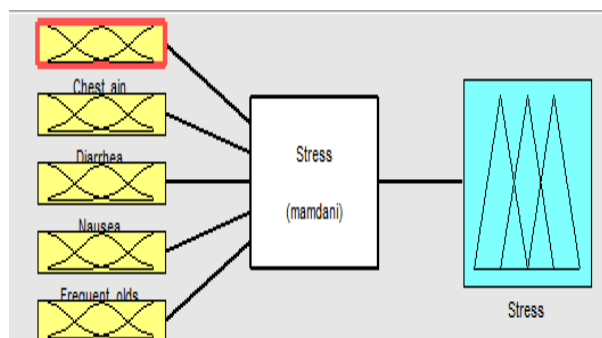


Figure.3.1 FIS of stress disorder

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(An ISO 3297: 2007 Certified Organization)

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Fig 3.2 shows the rules viewer of stress disorder. If the chest pain is low, diarrhea is low, Nausea is moderate, Frequent cold is low then the stress is on first stage.

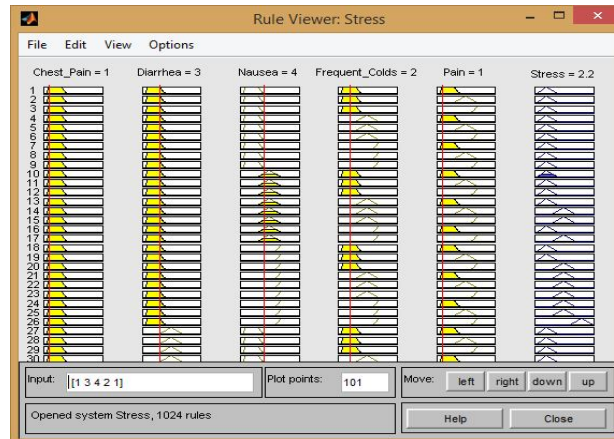


Figure 3.2 Rule Viewer of Stress

If the patient is unable to tell their physical symptoms then the user can fill the emotional symptoms from which he/she has suffering. Figure 3.3 shows the emotional symptoms of the stress disorder. It has major five symptoms from which it can occur. The patient has to tick mark the symptom from the check boxes. The expert system will diagnose the particular disorder

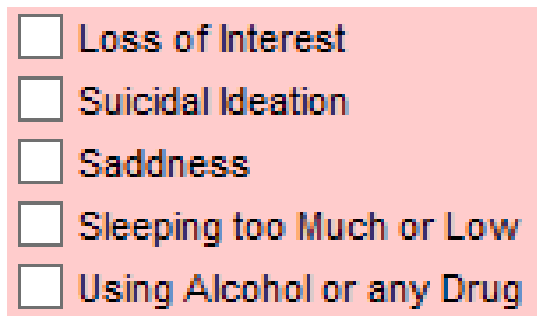


Figure 3.3 Emotional Symptom of Stress

3.2 Knowledge Representation

The knowledge of mental illness diagnoses expert system representation as fuzzy sets. We know that much knowledge in world is not precise. When the boundary of the information is not clear, fussiness occur. To make real world knowledge suitable for processes by computers, the fuzzy rules are generated for knowledge representation.

Let R be Rules of fuzzy production,

$$R = \{R_1, R_2, R_3, \dots, R_n\}$$

The formulation of R_i rule is $R_i, i=1,2,3,\dots,n$;

- R_i : If D_i Then d_i with $CF = \mu_i$
- D_i represents the facts portion of rules R_i
- μ_i represents the membership of certainty factor in R_i
- d_i represents conclusion portion of rules R_i

The fuzzy with more than two input(Facts) and one output is represented as collection of rules.

IF x_1 is a_1^k and x_2 is a_2^k THEN y^k is b^k

For $k=1,2,3,\dots,r$

Where a_1^k and a_2^k are the fuzzy set like very low, low, moderate, severe, and representing the k-th fact, b^k is the k-th conclusion.

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Table 1

S.no	Severe	Moderate	Low	Result%
Patient1	1	6	2	0.792
Patient2	3	3	3	0.823
Patient3	8	1	0	0.802
Patient4	7	1	1	0.896
Patient5	3	2	4	0.811
Patient6	2	5	2	0.78
Patient7	9	0	0	0.982

Table 1 shows the percentage of the disorder being present or not present. For example the patient4 has answered 7 times severe, one time moderate, and one time low, the percentage of being disorder is 89%.

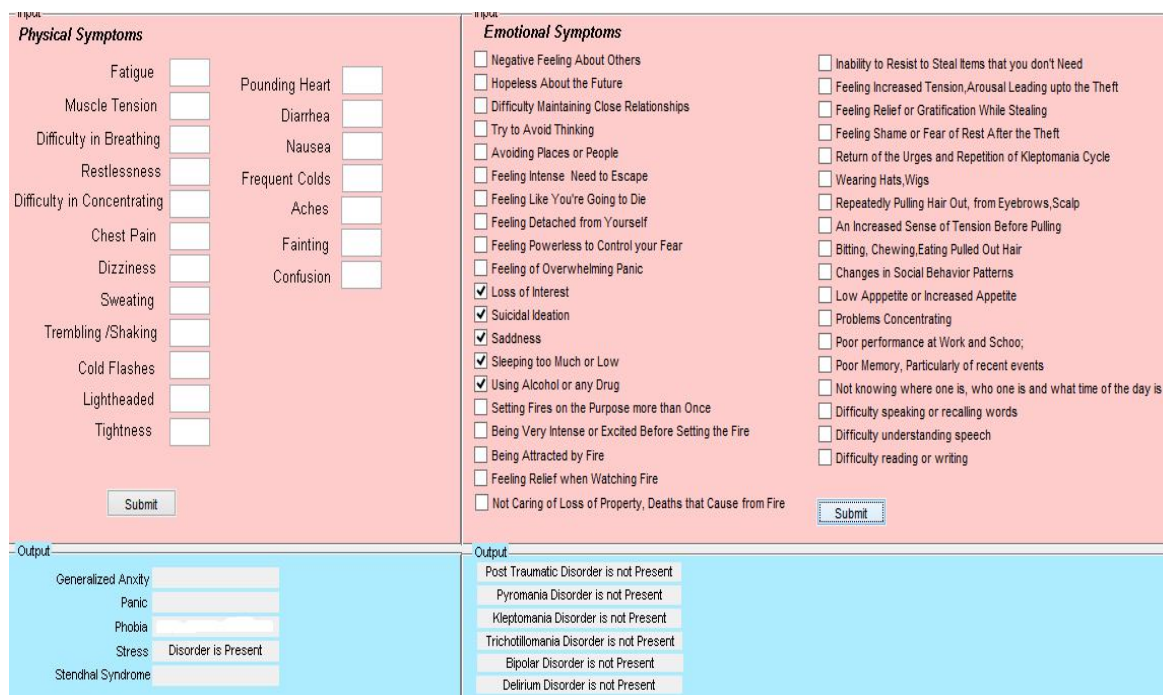


Figure 4 Mental illness diagnose expert system

IV. CONCLUSION

In this paper there is a development of fuzzy mental diagnose expert system. This system takes the input as physical and emotional symptom of the patient and diagnoses the particular disorder related to the psychology disorder. This system can be used by physician as well as by the patient in daily practice to diagnose the disorder easily. This system allow the doctor to follow their natural process for diagnose. This system does not learn any new procedure or method of doing things. Use of this expert system user should not feel like he/she the consultant of an exert but user should feel like an expert.



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